CLAIMS

What is claimed is:

1. A method for shaping a non-circular cross-sectional profile of flowing melt comprising the steps of:

injecting the melt into an extrusion die;

in the extrusion die, flowing the melt between a shaped bushing plate and shaped profile pin to shape the melt to the non-circular cross-sectional profile; and

shaping the wall thickness of the non-circular cross-sectional profile by moving a first adjustment plate having an opening of the non-circular cross-sectional profile about the pin, transverse to the flow of the melt, movement of the adjustment plate being restricted to be without rotation relative to the bushing plate.

2. The method of claim 1, wherein the step of shaping the wall thickness of the non-circular cross-sectional profile includes:

moving a first adjustment plate having an opening of the non-circular cross-sectional profile about the pin, transverse to the flow of the melt, movement of the adjustment plate being restricted to be along a first transverse axis

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3. The method of claim 2, wherein the step of shaping the wall thickness of the non-circular cross-sectional profile includes:

moving a second adjustment plate orthogonal to the first adjustment plate having an opening of the non-circular cross-sectional profile about the pin, movement of the second adjustment plate being restricted to be along a single second transverse axis orthogonal to the first transverse axis

4. The method of claim 3, wherein the step of shaping the wall thickness of the non-circular cross-sectional profile includes:

moving the first adjustment plate in a horizontal direction transverse to the flow of the melt; and

moving the second adjustment plate in the vertical direction transverse to the flow of the melt.

5. The method of claim 3, wherein the first and second adjustment plates are moved by adjustment screws.

6. An extrusion die comprising:

a bushing plate having a flow path therein shaping an exterior profile of melt flowing therethrough;

a profile pin within the flow path of the bushing plate shaping an interior profile of the flowing melt; and

a first adjustment plate facing the bushing plate and surrounding the profile pin and moveable in a direction transverse to the flow of the melt to provide a shift of the non-circular cross-sectional profile of the flowing melt, movement of the first adjustment plate being restricted to prevent rotation relative to the bushing plate.

7. The extrusion die of claim 6, wherein the first adjustment plate facing the bushing plate and surrounding the profile pin and moveable in a direction transverse to the flow of the melt to provide a shift of the non-circular cross-sectional profile of the flowing melt, movement of the first adjustment plate being restricted to be along a first transverse axis

8. The extrusion die of claim 6, wherein the bushing plate further comprises:

non-circular cross-sectional surfaces defining a flow path through the bushing plate to maintain the desired non-circular cross-sectional profile therethrough; and

opposing protrusions at a distal end from a face of the bushing plate defining at a distal end an adjustment channel which receives shoulders of a first adjustment plate and locates the first adjustment plate therein to prevent rotation of the first adjustment plate relative to the bushing plate.

9. The extrusion die of claim 7, wherein the first adjustment plate further comprises:

non-circular cross-sectional surfaces defining a flow path through the first adjustment plate to maintain the desired non-circular cross-sectional profile therethrough;

shoulders at a proximal end from a face of the first adjustment plate moveable within an adjusting channel of a bushing plate to prevent rotation of the first adjustment plate relative to the bushing plate; and

opposing adjusting channels from a distal face which receive shoulders of a second adjustment plate and locate the second adjustment plate therein to prevent rotation of the second adjustment plate relative to the first adjustment plate.

10. An extrusion die as claimed in claim 7 further comprising:

a second adjustment plate facing the first adjustment plate and surrounding the profile pin moveable orthogonal to the first adjustment plate to provide an orthogonal shift of the non-circular cross-sectional profile of the flowing melt, movement of the second adjustment plate being restricted to prevent rotation relative to the first adjustment plate.

11. The extrusion die of claim 10, wherein the second adjustment plate further comprises:

non-circular cross-sectional surfaces defining a flow path through the second adjustment plate to maintain the desired non-circular cross-sectional profile therethrough; and

opposing shoulders at a proximal end from a face of the second adjustment plate moveable within adjusting channels of a first adjustment plate to prevent rotation of the second adjustment plate relative to the first adjustment plate.

12. An extrusion die as claimed in claim 6 further comprising:

a first bushing plate defining a flow path to maintain the circular cross-sectional profile exterior of the flowing melt;

a second bushing plate defining a flow path to shape the circular melt exterior to the desired non-circular cross-sectional profile exterior of the flowing melt; and

a third bushing plate defining a flow path to maintain the desired non-circular cross-sectional profile exterior of the flowing melt.

13. An extrusion die as claimed in claim 6 further comprising:

a first section defining a flow path to maintain the circular cross-sectional profile interior of the flowing melt;

a second section defining a flow path to shape the circular melt interior to the desired non-circular cross-sectional profile interior of the flowing melt; and

a third section defining a flow path to maintain the desired non-circular cross-sectional profile interior of the flowing melt.

14. A bushing plate comprising:

non-circular cross-sectional surfaces defining a flow path through the bushing plate to maintain the desired non-circular cross-sectional profile therethrough; and

opposing protrusions at a distal end from a face of the bushing plate defining at a distal end an adjustment channel which receives shoulders of a first adjustment plate and locates the first adjustment plate therein to prevent rotation of the first adjustment plate relative to the bushing plate.

15. A first adjustment plate comprising:

non-circular cross-sectional surfaces defining a flow path through the first adjustment plate to maintain the desired non-circular cross-sectional profile therethrough;

shoulders at a proximal end from a face of the first adjustment plate moveable within an adjusting channel of a bushing plate to prevent rotation of the first adjustment plate relative to the bushing plate; and

opposing adjusting channels from a distal face which receive shoulders of a second adjustment plate and locate the second adjustment plate therein to prevent rotation of the second adjustment plate relative to the first adjustment plate.

16. A second adjustment plate comprising:

non-circular cross-sectional surfaces defining a flow path through the second adjustment plate to maintain the desired non-circular cross-sectional profile therethrough; and

opposing shoulders at a proximal end from a face of the second adjustment plate moveable within adjusting channels of a first adjustment plate to prevent rotation of the second adjustment plate relative to the first adjustment plate.

17. An apparatus for shaping a non-circular cross-sectional profile comprising:

means for injecting the circular melt into a extrusion die;

means for transforming the circular melt into a non-circular cross-sectional profile; and

means for adjusting the wall thickness of the non-circular cross-sectional profile.